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SOVIET EXPERIMENTS WITH COAL-CUTTING MACHINES

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/Tables referred to are appended/

By 1949, 3-, 4-, and 5-meter cutting bars were being used in a number of Pechora basin coal mines in cutting dipping seams from 0.7 to 2.5 meters thick with an angle of dip ranging from 20-35 degrees. A 2-year experiment has disproved the prevailing opinion that a long cutting bar is unsuitable for cutting machines. It has been proved that the use of long bars increases all technical and economic indexes considerably and creates conditions leading to the most productive utilization of cutting machines.

The experience of one of the Pechora basin mines, where all the KMP-1 cutting machines are operating with lengthened bars, is of interest in this connection. Data on this mine and the coal seams being worked in it appear in Table 1.

Natural conditions greatly affect the performance indexes of cutting machines with long bars. Thus, the best indexes were achieved at the southern faces of the mine where a surface cleavage creates conditions favorable to the automatic breaking up of the coal face. In some sections where the coal was hard and tough and was broken up only with difficulty, the productivity of the cutting machine was lowered.

In cases where it is possible to achieve an almost complete automatic breaking up of the coal (90 percent), a machine with a 3-, 4-, or 5-meter cutting bar is used, and cutting is carried out from below to above the floor of the seam. As the cutting bar passes on, a slice of the lower part of the seam breaks off and falls in small pieces. As the cutting machine moves on 0.5-1.5 meters, the top block of coal is sliced off from the roof and, being tough, breaks into larger but still portable pieces. About 10 percent, still left in the roof, is broken up by blasting.

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After the coal has been extracted, chutes with sections about 10 meters long are laid along the new machine road and, to direct the coal to these, sloping chutes are installed along the dip of the coal block. Because of the steepness of the angle, the coal falls into the chutes. When a deep cut has been made into the seam, temporary as well as permanent props must be set up.

In cases where it is possible to achieve only a partial automatic breaking-up of the coal (33-50 percent), cutting is carried out with a 3-meter bar. The coal is removed in two blocks, an upper and a lower one. Where the coal block is 2.8 meters wide, it breaks up to a width of 0.8-1.2 meters. Cutting starts in the lower block. After the machine has moved on for 5 or 6 meters, it is stopped and the coal in the block which did not break up automatically is drilled, blasted, and loaded. Temporary props are set up and then the cutting and removal of the top block starts.

Methods of operating with 3-, 4-, and 5-meter cutting bars resemble each other. The difference consists merely in that, as the depth of the cut increases, the amount of coal which breaks up automatically increases, too, and all performance indexes are improved. The best performance (of a number not depending on the thickness of the seam) was achieved in seam C, working with a 5-meter bar, where the monthly advance of the face was 56 meters and the monthly productivity of the machine was 10,151 tons.

Table 2 gives comparative data on the performance of the standard 2-meter bar in contrast to the performance of the longer cutting bar.

Table 3 converts the performance of long cutting bars to a percent of the performance of 2-meter bars. Table 4 indicates the coefficient of exploitation of the capacity of KMP cutting machines all using long bars.

/Appended tables follow./

Table 1. Coal Seams and Faces of Pechora Basin Mine

	Seam A	Seam B	Seam C
Thickness of seam (m)	1.45-1.55	0.95-1.10	0.7-0.75
Predominating angle of dip (deg)	33	33	33
Min angle of dip (deg)	33	23-28	20
Length of face (m)	175-185	85-135-175	125-175
Toughness of coal	Av	Below Av	Av
Immediate roof	Slightly firm argillite, 2 m thick	Medium firm argillite, 3 m thick	Soft argillite, dome-shaped
Floor	Hard siltstone	Hard siltstone	Siltstone

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	Seam A	Seam B	Seam C
Method of roof control	Complete caving	Partial back-filling	Partial back-filling
Method of mining	Longwall, working one level	Longwall with one level and with division into sublevels	Longwall with one level and with division into sublevels

Table 2. Comparative Performances of Cutting Bars

	Seam A			Seam B								Seam C					
	2m Bar South	3m Bar South	4m Bar South	2 m Bar North	2 m Bar South	2 m Bar Av	3 m Bar North	3 m Bar South	3 m Bar Av	5 m Bar South	2 m Bar North	2 m Bar South	2 m Bar Av	3 m Bar North	3 m Bar South	3 m Bar Av.
Length of face (lin m)	171	173	171	183	150	167.4	183	150	161.4	136	166	165	165.3	166	165	165.1
Av daily output (t)	305	410	438	189	187	188	257	284	271.4	317	103	100	100.9	162	186	173.6
Monthly advance of face (lin m)	27.2	34.0	36.3	22.7	27.2	24.7	30.8	40.0	33.4	49.3	19.6	17.3	17.99	28.1	32.2	31.5
Monthly output of machine (t)	8,755	12,083	12,513	5,970	5,665	5,510	7,298	8,681	7,902	9,253	3,654	3,671	2,948	4,818	5,968	5,023
Monthly output of machine (sq m)	4,653	5,877	6,202	4,155	4,074	4,117	5,648	5,998	5,875	6,705	3,256	2,858	2,978.4	4,658	5,309	4,960
Output per worker at face (t)	4.84	6.64	7.56	3.01	3.00	3.01	3.84	4.98	3.96	5.08	2.11	2.23	1.93	2.87	3.63	2.93
Output per worker (t)	4.06	5.84	6.89	2.71	2.69	2.65	3.40	4.63	3.5	4.74	1.84	1.92	1.59	2.54	3.37	2.57
Consumption of mine timbers per 1,000 t of output (cu m)	32.0	27.1	28.6	24.3	23.2	23.8	28.0	29.3	28.6	25.0	31.7	28.9	28.7	80.0	28.3	29.1
Consumption of explosives per t of output(kg)	0.172	0.097	0.081	0.145	0.119	0.133	0.131	0.097	0.109	0.078	0.260	0.181	0.247	0.154	0.107	0.131

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Table 3. Performance of Long Cutting Bars in Percent of Performance of 2-Meter Bars

	Seam A			Seam B			Seam C	
Length of bar (m)	2.0	3.0	4.0	2.0	3.0	5.0	2.0	3.0
Length of face	100	101.1	96.5	100	96.0	82.0	100	99.8
Av daily output of face	100	134.9	144.0	100	145.5	168.0	100	172.0
Monthly advance of face	100	125.8	132.0	100	135.0	198.0	100	176.5
Monthly output of machine (t)	100	132.2	139.5	100	134.2	162.8	100	170.3
Monthly output of machine (sq m)	100	126.5	133.0	100	142.6	163.0	100	166.5
Output per worker at face	100	129.4	144.5	100	131.6	157.1	100	151.8
Output per worker	100	143.8	166.8	100	132.0	166.0	100	161.6
Consumption of mine timbers per t of output	100	84.6	89.3	100	120.0	105.0	100	101.4
Consumption of explosives per t of output	100	56.4	47.9	100	82.0	58.6	100	53.0
Section production costs per t	100	85.4	80.3	100	90.1	80.4	100	87.4
Ash content	100	96.6	97.9	100	93.4	93.3	100	100.0

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Table 4. Exploitation of Capacity of KMP-1 Cutting Machine

No of Section	Length of Bar (m)	Current (a)	Power (w)	Coef of Utilization of Elec Motor with 47-KW Hourly Capacity
3	3.0	75	40.8	0.86
5	5.0	70	38.1	0.81
7	3.0	72	39.2	0.83
10	4.0	68	37.0	0.80

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